

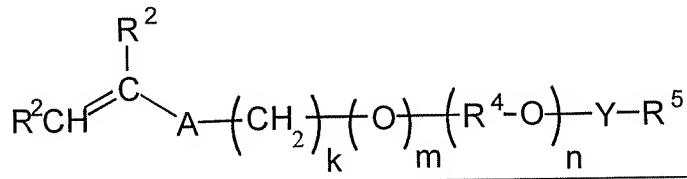
IN THE CLAIMS:

1. (currently amended) A polymer that is the product of polymerization of a monomer mixture comprising:

- a) at least one amino-substituted vinyl monomer;
- b) at least one hydrophobic nonionic vinyl monomer;
- c) at least one associative vinyl monomer; and
- d) at least one semihydrophobic vinyl surfactant monomer;

wherein said at least one associative vinyl monomer (c) is selected from at least one monomer represented by formula (III):

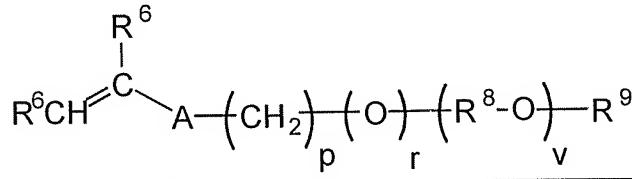
(III)



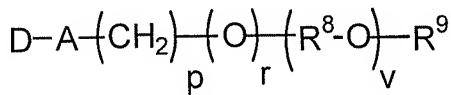
wherein, each R² is independently selected from hydrogen, methyl, -C(O)OH, and -C(O)OR³; R³ is selected from C₁-C₃₀ alkyl; A is selected from -CH₂C(O)O-, -C(O)O-, -O-, -CH₂O-, -NHC(O)NH-, -C(O)NH-, -Ar-(CE₂)_z-NHC(O)O-, -Ar-(CE₂)_z-NHC(O)NH-, and -CH₂CH₂NHC(O)-; Ar is a divalent aryl; E is selected from hydrogen and methyl; z is 0 or 1; k is an integer in the range of 0 to about 30, and m is 0 or 1, with the proviso that when k is 0, m is 0, and when k is in the range of 1 to about 30, m is 1; (R⁴-O)_n is a polyoxyalkylene, which can be a homopolymer, a random copolymer, or a block copolymer of C₂-C₄ oxyalkylene units, wherein R⁴ is -C₂H₄-, -C₃H₆-, or -C₄H₈-, or a mixture thereof, and n is an integer in the range of about 5 to about 250; Y is selected from -R⁴O-, -R⁴NH-, -C(O)-, -C(O)NH-, -R⁴NHC(O)NH-, and -C(O)NHC(O)-; and R⁵ is a substituted or unsubstituted alkyl selected from C₈-C₄₀ linear alkyl, C₈-C₄₀ branched alkyl, C₈-C₄₀ carbocyclic alkyl, a C₂-C₄₀ alkyl-substituted phenyl, an aryl-substituted C₂-C₄₀ alkyl, and C₈-C₈₀ complex ester; wherein the R⁵ alkyl group optionally having one or more substituents selected from a hydroxyl group, an alkoxy group, and a halogen group; and

wherein said at least one semihydrophobic vinyl surfactant monomer (d) is selected from at least one monomer represented by formulas (IV) or (V) and combinations thereof:

(IV)



(V)



wherein, in each of formulas (IV) and (V), each R⁶ is independently selected from hydrogen, C₁-C₃₀ alkyl, -C(O)OH, and -C(O)OR⁷; R⁷ is selected C₁-C₃₀ alkyl; A is selected from -CH₂C(O)O-, -C(O)O-, -O-, -CH₂O-, -NHC(O)NH-, -C(O)NH-, -Ar-(CE₂)_z-NHC(O)O-, -Ar-(CE₂)_z-NHC(O)NH-, and -CH₂CH₂NHC(O)-; Ar is a divalent aryl; E is selected from hydrogen and methyl; z is 0 or 1; p is an integer in the range of 0 to about 30, and r is 0 or 1, with the proviso that when p is 0, r is 0, and when p is in the range of 1 to about 30, r is 1; (R⁸-O)_v is a polyoxyalkylene, which can be a homopolymer, a random copolymer or a block copolymer of C₂-C₄ oxyalkylene units, wherein R⁸ is -C₂H₄-, -C₃H₆-, -C₄H₈-, or a mixture thereof, and v is an integer in the range of about 5 to about 250; R⁹ is selected from hydrogen and C₁-C₄ alkyl; and D is selected from C₈-C₃₀ unsaturated alkyl, and carboxy-substituted C₈-C₃₀ unsaturated alkyl.

2. (original) The polymer of claim 1 wherein the amino-substituted vinyl monomer is selected from:

- a mono-(C₁-C₄)alkylamino(C₁-C₈)alkyl (meth)acrylate,
- a di-(C₁-C₄)alkylamino(C₁-C₈)alkyl (meth)acrylate,
- a mono-(C₁-C₄)alkylamino(C₁-C₈)alkyl (meth)acrylamide,
- a di-(C₁-C₄)alkylamino(C₁-C₈)alkyl (meth)acrylamide,
- a nitrogen-containing heterocyclic (meth)acrylamide,

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a nitrogen-containing heterocyclic (meth)acrylate, and a mixture thereof.

3. (currently amended) The polymer of claim 1 wherein the hydrophobic nonionic vinyl monomer is selected from a compound having either of the following formulas (I) or (II) (I), (II), and combinations thereof:



wherein, in each of formulas (I) and (II), X is H or methyl; and Z is $-\text{C}(\text{O})\text{OR}^1$, $-\text{C}(\text{O})\text{NH}_2$, $-\text{C}(\text{O})\text{NHR}^1$, $-\text{C}(\text{O})\text{N}(\text{R}^1)_2$, $-\text{C}_6\text{H}_4\text{R}^1$, $-\text{C}_6\text{H}_4\text{OR}^1$, $-\text{C}_6\text{H}_4\text{Cl}$, $-\text{CN}$, $-\text{NHC}(\text{O})\text{CH}_3$, $-\text{NHC}(\text{O})\text{H}$, $\text{N}-(2\text{-pyrrolidonyl})$, N -caprolactamyl, $-\text{C}(\text{O})\text{NHC}(\text{CH}_3)_3$, $-\text{C}(\text{O})\text{NHCH}_2\text{CH}_2\text{-N-ethyleneurea}$, $-\text{SiR}_3$, $-\text{C}(\text{O})\text{O}(\text{CH}_2)_x\text{SiR}_3$, $-\text{C}(\text{O})\text{NH}(\text{CH}_2)_x\text{SiR}_3$, or $-(\text{CH}_2)_x\text{SiR}_3$; x is an integer in the range of 1 to about 6; each R is independently $\text{C}_1\text{-C}_{30}$ alkyl; each R^1 is independently $\text{C}_1\text{-C}_{30}$ alkyl, hydroxy-substituted $\text{C}_2\text{-C}_{30}$ alkyl or halogen-substituted $\text{C}_1\text{-C}_{30}$ alkyl.

4. (original) The polymer of claim 1 wherein the hydrophobic nonionic vinyl monomer is a $\text{C}_1\text{-C}_{30}$ alkyl ester of acrylic acid, a $\text{C}_1\text{-C}_{30}$ alkyl ester of methacrylic acid, or a mixture thereof.

5. Cancel

6. Cancel

7. (currently amended) The polymer of claim 6 1 wherein the polyoxyalkylene group is a homopolymer, a random copolymer, or a block copolymer comprising about 5 to about 250 $\text{C}_2\text{-C}_4$ oxyalkylene units.

8. Cancel

9. (currently amended) A polymer of claim 1 that is the product of polymerization of a monomer mixture comprising, on a total monomer mixture weight basis:

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- (a) about 10 to about 70 weight percent of at least one amino-substituted vinyl monomer or a salt thereof;
- (b) about 20 to about 80 weight percent of at least one hydrophobic nonionic vinyl monomer;
- (c) about 0.01 to about 25 weight percent of at least one associative vinyl monomer;
- (d) about 0.01 to about 25 weight percent of at least one semihydrophobic vinyl surfactant monomer;
- (e) up to about 10 weight percent of a hydroxy-substituted nonionic vinyl monomer;
- (f) up to about 5 weight percent of a crosslinking monomer;
- (g) up to about 10 weight percent of a chain transfer agent; and
- (h) up to about 2 weight percent of a polymeric stabilizer.

10. (original) The polymer of claim 9 wherein the amino-substituted vinyl monomer is selected from:

a mono-(C₁-C₄)alkylamino(C₁-C₈)alkyl (meth)acrylate,
a di-(C₁-C₄)alkylamino(C₁-C₈)alkyl (meth)acrylate,
a mono-(C₁-C₄)alkylamino(C₁-C₈)alkyl (meth)acrylamide,
a di-(C₁-C₄)alkylamino(C₁-C₈)alkyl (meth)acrylamide,
a nitrogen-containing heterocyclic (meth)acrylamide,
a nitrogen-containing heterocyclic (meth)acrylate, and a mixture thereof.

11. (currently amended) The polymer of claim 9 wherein the hydrophobic nonionic vinyl monomer is selected from a compound having either of the following formulas (I) or (II) (I), (II), and combinations thereof:

- (I) CH₂=C(X)Z,
- (II) CH₂=CH-OC(O)R;

wherein, in each of formulas (I) and (II), X is H or methyl; and Z is -C(O)OR¹, -C(O)NH₂, -C(O)NHR¹, -C(O)N(R¹)₂, -C₆H₄R¹, -C₆H₄OR¹, -C₆H₄C1, -CN, -NHC(O)CH₃, -NHC(O)H, N-(2-pyrrolidonyl), N-caprolactamyl, -C(O)NHC(CH₃)₃, -C(O)NHCH₂CH₂-N-ethyleneurea, -SiR₃, -C(O)O(CH₂)_xSiR₃, -C(O)NH(CH₂)_xSiR₃, or -(CH₂)_xSiR₃; x is an integer in the range of 1

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to about 6; each R is independently C₁-C₃₀ alkyl; each R¹ is independently C₁-C₃₀ alkyl, hydroxy-substituted C₂-C₃₀ alkyl or halogen-substituted C₁-C₃₀ alkyl.

12. (original) The polymer of claim 9 wherein the hydrophobic nonionic vinyl monomer is a C₁-C₃₀ alkyl ester of acrylic acid, a C₁-C₃₀ alkyl ester of methacrylic acid, or a mixture thereof.

13. Cancel

14. Cancel

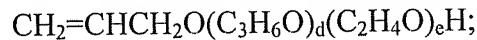
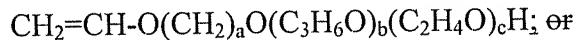
15. (currently amended) The polymer of claim 9 10 wherein ~~the amino-substituted vinyl monomer is said monomers are selected from:~~

~~3-(N,N-dimethylamino)propyl (meth)acrylate,~~
~~N-(3-N,N-dimethylamino)propyl (meth)acrylamide, 2-(N,N-dimethylamino)ethyl methacrylate,~~
~~2-(N,N-diethylamino)ethyl methacrylate,~~
~~2-(tert-butylamino)ethyl methacrylate,~~
~~2-(N,N-dimethylamino)propyl methacrylamide, and~~
~~2-(N,N-dimethylamino)neopentyl acrylate.~~

(b) about 50 to about 65 weight percent of at least one hydrophobic nonionic vinyl monomer selected from a C₁-C₃₀ alkyl ester of acrylic acid, a C₁-C₃₀ alkyl ester of methacrylic acid, and a mixture thereof;

(c) about 0.1 to about 10 weight percent of at least one associative vinyl monomer selected from cetyl polyethoxylated methacrylate, cetearyl polyethoxylated methacrylate, stearyl polyethoxylated (meth)acrylate, arachidyl polyethoxylated (meth)acrylate, behenyl polyethoxylated methacrylate, lauryl polyethoxylated methacrylate, cerotyl polyethoxylated (meth)acrylate, montanyl polyethoxylated (meth)acrylate, melissyl polyethoxylated (meth)acrylate, lacceryl polyethoxylated (meth)acrylate, tristyryl phenolpolyethoxylated methacrylate, hydrogenated castor oil polyethoxylated methacrylate, canola polyethoxylated (meth)acrylate, and cholesterol polyethoxylated methacrylate;

(d) about 0.1 to about 10 weight percent of at least one semihydrophobic vinyl surfactant monomer is selected from a compound represented by having one of the following chemical formulas and combinations thereof:



wherein a is 2, 3, or 4; b is an integer in the range of 1 to about 10; c is an integer in the range of about 5 to about 50; d is an integer in the range of 1 to about 10; and e is an integer in the range of about 5 to about 50;

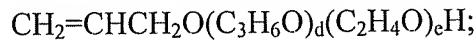
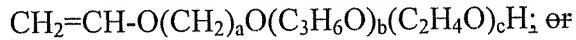
- (e) up to about 10 weight percent of a hydroxy-substituted nonionic vinyl monomer;
- (f) up to about 5 weight percent of a crosslinking monomer;
- (g) up to about 10 weight percent of a chain transfer agent; and
- (h) up to about 2 weight percent of a polymeric stabilizer.

16. (original) The polymer of claim 9 wherein the associative vinyl monomer is selected from cetyl polyethoxylated methacrylate, cetearyl polyethoxylated methacrylate, stearyl polyethoxylated (meth)acrylate, arachidyl polyethoxylated (meth)acrylate, behenyl polyethoxylated methacrylate, lauryl polyethoxylated methacrylate, cerotyl polyethoxylated (meth)acrylate, montanyl polyethoxylated (meth)acrylate, melissyl polyethoxylated (meth)acrylate, lacceryl polyethoxylated (meth)acrylate, tristyryl phenolpolyethoxylated methacrylate, hydrogenated castor oil polyethoxylated methacrylate, canola polyethoxylated (meth)acrylate, and cholesterol polyethoxylated methacrylate, and a mixture thereof.

17. Cancel

18. (currently amended) The polymer of claim 17 15 wherein the polyoxyalkylene group in said semihydrophobic monomer is a homopolymer, a random copolymer, or a block copolymer comprising having about 5 to about 250 C₂-C₄ oxyalkylene units.

19. (currently amended) The polymer of claim 9 wherein the monomer mixture includes a semihydrophobic vinyl surfactant monomer is selected from a compound represented by having one of the following chemical formulas and combinations thereof:



wherein a is 2, 3, or 4; b is an integer in the range of 1 to about 10; c is an integer in the range of about 5 to about 50; d is an integer in the range of 1 to about 10; and e is an integer in the range of about 5 to about 50.

20. (original) The polymer of claim 9 wherein the monomer mixture comprises about 0.01 to about 10 weight percent of at least one hydroxy-substituted nonionic vinyl monomer, based on the total monomer mixture weight.

21. (original) The polymer of claim 20 wherein the hydroxy-substituted nonionic vinyl monomer is selected from a hydroxy-substituted(C₁-C₄)alkyl acrylate, a hydroxy-substituted(C₁-C₄)alkyl methacrylate, hydroxy-substituted(C₁-C₄)alkyl acrylamide, a hydroxy-substituted(C₁-C₄)alkyl methacrylamide, and a mixture thereof.

22. (original) The polymer of claim 20 wherein the hydroxy-substituted nonionic vinyl monomer is 2-hydroxyethyl methacrylate.

23. The polymer of claim 9 wherein the monomer mixture contains about 0.01 to about 3 weight percent of at least one crosslinking monomer, based on the total monomer mixture weight.

24. (original) The polymer of claim 23 wherein the crosslinking monomer is an acrylate ester of a polyol having at least two acrylate ester groups, a methacrylate ester of a polyol having at least two methacrylate ester groups or a combination thereof.

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25. (original) The polymer of claim 9 wherein the monomer mixture contains at least about 0.1 weight percent of a chain transfer agent, based on the total monomer mixture weight.

26. (original) The polymer of claim 25 wherein the chain transfer agent is selected from a thio compound, a disulfide compound, a phosphite, a hypophosphite, a haloalkyl compound, and a combination thereof.

27. (original) A polymer that is the product of polymerization of a monomer mixture comprising, on a total monomer mixture weight basis:

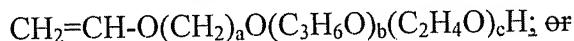
(a) about 20 to about 50 weight percent of at least one amino-substituted vinyl monomer selected from:

3-(N,N-dimethylamino)propyl (meth)acrylate,
N'-(3-N,N-dimethylamino)propyl (meth)acrylamide. 2-(N,N-dimethylamino)ethyl methacrylate,
2-(N,N-diethylamino)ethyl methacrylate,
2-(tert-butylamino)ethyl methacrylate,
2-(N,N-dimethylamino)propyl methacrylamide, and
2-(N,N-dimethylamino)neopentyl acrylate.

(b) about 50 to about 65 weight percent of at least one hydrophobic nonionic vinyl monomer selected from a C₁-C₃₀ alkyl ester of acrylic acid, a C₁-C₃₀ alkyl ester of methacrylic acid, and a mixture thereof;

(c) about 0.1 to about 10 weight percent of at least one associative vinyl monomer selected from cetyl polyethoxylated methacrylate, cetearyl polyethoxylated methacrylate, stearyl polyethoxylated (meth)acrylate, arachidyl polyethoxylated (meth)acrylate, behenyl polyethoxylated methacrylate, lauryl polyethoxylated methacrylate, cerotyl polyethoxylated (meth)acrylate, montanyl polyethoxylated (meth)acrylate, melissyl polyethoxylated (meth)acrylate, lacceryl polyethoxylated (meth)acrylate, tristyryl phenolpolyethoxylated methacrylate, hydrogenated castor oil polyethoxylated methacrylate, canola polyethoxylated (meth)acrylate, and cholesterol polyethoxylated methacrylate;

(d) about 0.1 to about 10 weight percent of at least one semihydrophobic vinyl surfactant monomer is selected from a compound represented by having one of the following chemical formulas and combinations thereof:



wherein a is 2, 3, or 4; b is an integer in the range of 1 to about 10; c is an integer in the range of about 5 to about 50; d is an integer in the range of 1 to about 10; and e is an integer in the range of about 5 to about 50;

- (e) up to about 10 weight percent of a hydroxy-substituted nonionic vinyl monomer;
- (f) up to about 5 weight percent of a crosslinking monomer;
- (g) up to about 10 weight percent of a chain transfer agent; and
- (h) up to about 2 weight percent of a polymeric stabilizer.

28. (original) The polymer of claim 27 wherein the monomer mixture comprises about 1 to about 5 weight percent of at least one hydroxy-substituted nonionic vinyl monomer, based on the total monomer mixture weight.

29. (original) The polymer of claim 28 wherein the hydroxy-substituted nonionic vinyl monomer is selected from a hydroxy-substituted(C₁-C₄)alkyl acrylate, a hydroxy-substituted(C₁-C₄)alkyl methacrylate, hydroxy-substituted(C₁-C₄)alkyl acrylamide, and a hydroxy-substituted(C₁-C₄)alkyl methacrylamide, and a mixture thereof.

30. (original) The polymer of claim 28 wherein the hydroxy-substituted nonionic vinyl monomer is 2-hydroxyethyl methacrylate.

31. (original) The polymer of claim 27 wherein the monomer mixture comprises about 0.01 to about 3 weight percent of a crosslinking monomer, based on the total monomer mixture weight.

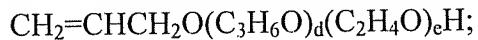
32. (original) The polymer of claim 31 wherein the crosslinking monomer is an acrylate ester of a polyol having at least two acrylate ester groups, a methacrylate ester of a polyol having at least two methacrylate ester groups or a mixture thereof.

33. (original) The polymer of claim 27 wherein the monomer mixture comprises at least about 0.1 percent by weight of a chain transfer agent, based on the total monomer mixture weight.

34. (original) The polymer of claim 33 wherein the chain transfer agent is selected from a thio compound, a disulfide compound, a phosphite, a hypophosphite, a haloalkyl compound, and a mixture thereof.

35 to 71. Cancel

72. (new) The polymer of claim 1 wherein the at least one semihydrophobic vinyl surfactant monomer is selected from a compound represented by one of the following chemical formulas and combinations thereof:



wherein a is 2, 3, or 4; b is an integer in the range of 1 to about 10; c is an integer in the range of about 5 to about 50; d is an integer in the range of 1 to about 10; and e is an integer in the range of about 5 to about 50.